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treille did so nearly a century ago (in 1825), but almost all later Europeans have looked with much disfavor on such a separation. It must not be forgotten, either, that L. Agassiz, over half a century ago (in 1857), also separated the Selachians as a distinct class but, it should be said, he also differentiated the "Ganoids" as an equally distinct class.³ It is scarcely necessary to add that the reasons for the present differentiation of the Selachians are different from those influencing the early zoologists.

It may be hoped, in the interests of vertebrate morphology, that the view that has at last found favor among such active European naturalists as those noticed will be more prevalent than heretofore.

THEO. GILL

SEVENTH ANNUAL MEETING OF THE AMERICAN SOCIETY OF VERTEBRATE PALEONTOLOGISTS

THE seventh annual meeting was held in the geological laboratory of Johns Hopkins University, Baltimore, Md., December 28-30, 1908.

The meeting was called to order by President R. S. Lull on Monday, December 28, at 2:30 P.M. The minutes of the preceding meeting were read and approved. The treasurer's report was read and accepted. A letter from Professor W. B. Clarke was read, giving notice of courtesies extended to the society. A letter from the U. S. Fish Commission was read, acknowledging receipt of resolution regarding extinction of the great marine mammals, stating the sympathy of the commission with the views there expressed, and asking for suggestions in regard to prevention of this extermination.

The president appointed Messrs. Williston, Case and Matthew a committee to nominate officers for the ensuing year.

On motion it was resolved that the business meeting be postponed until 10:30 A.M. on Wednesday and that the meeting proceed to the reading of papers.

The reading of the presidential address by R. S. Lull, on "Dinosaur Societies," followed. The ad-

³ Agassiz, "Cont. to Nat. Hist. U. S.," I., 1857, p. 187. Agassiz recognized three orders of Selachians ("Chimeræ, Galeodes and Batides") and six (?) orders of Ganoids ("three orders, Cœlacanth, Acipenseroids and Sauroids; and doubtful, the Siluroids, Plectognaths and Lophobranchs").

dress discussed the relationships and the geological and geographical distribution of the several groups of *Dinosauria* and suggested hypotheses of phylogeny and migration to explain these facts of distribution. (The address will be published elsewhere.)

Discussion: Dr. Williston expressed his sense of the importance and interest of the paper. He did not agree with the author in making the early Mesozoic migrations via a North Atlantic land bridge; a more probable alternative was by way of southern land connections. In favor of this view he pointed out our lack of knowledge of southern Mesozoic land faunæ, the easier communication at that time between the southern continents, and especially the presence of certain common types, such as Dicynodonts, in the early Mesozoic land faunæ of North America and Africa, although they are not found in the intervening northern land masses. He agreed with Professor Lull as to the Triassic age of *Nanosaurus*. In support of the lower Cretaceous age of a part of the Morrison formation he cited the discovery of *Morosaurus*, a Morrison genus, in the lower Cretaceous Trinity sandstone of Oklahoma. He believed that the American upper Cretaceous genera *Palæoscincus* (Judith River), *Stegopelta* (Lower Benton) and *Ankylosaurus* (Hell Creek) were closely related, if not identical, and were all derivable from *Polacanthus* of the Wealden of Europe. The recent discovery of *Ceratopsia* and of *Hadrosaurus* in the European Cretaceous reduces still further the supposed isolation of our late Cretaceous land fauna from that of Europe.

The meeting then adjourned. The second session was called to order at 9:30 A.M. Tuesday.

A specimen from the Conemaugh beds of West Virginia was submitted for discussion by Dr. White. The specimen appears to be the tibia or radius of a large reptile. Its nature and relationships were discussed especially by Drs. Williston, Case and Dean. It was considered to be beyond doubt a bone or natural cast of a bone of a large Pareiasaurian, exceeding in size and considerably older geologically than any known member of the order. On motion it was resolved that the society expresses its sense of the importance of the specimen and of the desirability of having it fully described and illustrated.

Dr. Williston then exhibited articulated skeletons of *Pariotichus* and *Lysorophus*, obtained for the University of Chicago in western Texas last summer. The reptiles of the American Permian included four chief groups, the Pelycosaurs, the Cotylosaurs (including Chelydrosauria) the *Pari-*

otichus group and one other. The *Pariotichus* group is ordinarily but not closely related to *Procolophon*. They were low, clumsy, crawling reptiles, large headed, with very primitive skull construction, pectoral girdle very primitive except for absence of cleithrum, 22-24 thoracic vertebræ, no intercentra, imperfectly double-headed ribs, some ventral armature, and very primitive, flat, plate-like pelvis. The phalangeal formula is not yet proved; there is no evidence as yet of the chelonian formula in any Permian reptile, and it is probably derived from the older formula with more numerous phalanges; the cervical vertebræ are short and few in number; the animal had practically no neck, as in the contemporary amphibians. The characters of *Lysorophus* have been stated in a recent publication by Dr. Williston; an important discovery is of evidence that it possessed completely formed limbs, although of small relative size.

Discussion: Dr. E. C. Case observed in regard to the abdominal ribs of the *Pariotichidæ*, that they were present in certain specimens discovered by him last summer. The absence of intercentra was confirmed and its significance considered. The essential similarity, aside from a few highly specialized characters, of all these Permian forms as noted by Dr. Williston, is only explainable as a retention of primitive characters.

This paper was followed by "Notes on a Collecting Trip in the Permian of Texas, during the Summer of 1908," by Dr. E. C. Case. The author discussed the stratigraphy and conditions of deposition of the Texas red beds. No very satisfactory arrangement of these strata has yet been made. Professor Cummins's earlier arrangement was into (1) Wichita, (2) Clear Fork, (3) Double Mountain, successively overlying the Albany limestones, the Clear Fork being the chief fossiliferous horizon. The first two divisions are not clearly separable in Dr. Case's opinion. The succession in the part of the region studied by him was as follows:

(4) Conglomerate and sandstone layer similar to that below.

(3) Red clay, about 20 feet.

(2) Conglomerate layer, varying to a cross-bedded sandstone.

(1) Red clays.

The upper conglomerate forms the top of the country in the eastern part of the region. The sandstone is composed of æolian sand, the conglomerate of rather angulate pebbles. West of Dundee the upper and lower conglomerate members come together and at the junction is a heavy

bone bed. West of this comes in a new conglomerate layer. The strata were regarded as deposited along a lagoon-coast into which were washed the remains of animals and sediment from the dry land. They are not, strictly speaking, estuarine. Little is yet known of the geographic or geologic distribution of the fauna. The genus *Diplocaulus*, abundant north of the Wichita, has not been found south of it. Remains of insects—two well-preserved wings—were discovered by Dr. Case last summer, their first discovery in this fauna. Other interesting discoveries were a new reptile of small size and a new amphibian allied to *Zatrachys* or *Aspidosaurus*.

Discussion: Dr. Williston inquired whether the author considered that these beds indicated arid climatic conditions. Dr. Case: The beds themselves probably not, but the back country may have been arid; the bones occur chiefly in the conglomerate; in the clays they are very rare, but when found are apt to be articulated skeletons. This fauna was at least in part made up of dry land animals; the construction of the feet in *Dimetrodon* and *Naosaurus* is evidence for this view.

Dr. Gordon took some exception to the author's explanation of the stratigraphy, and discussed the relations of the sandstone layers. Dr. Williston observed that his experience last summer confirmed the general accuracy of Dr. Case's stratigraphy, but that river channels appeared to be more abundant; he illustrated a typical example which he had noted.

Dr. Gordon further discussed the paper, pointing out that the so-called Permian red beds of this region are in fact a northward continuation of the Albany limestone itself, instead of an overlying formation. This had been suspected by Dr. Cummins himself in the later years of his work.

Dr. David White discussed the relations of the plants of the formation and its geological age. In his opinion, it is probably Permian and not Carboniferous. The evidence of aridity did not seem very convincing. Dr. Gordon: As originally applied the Clear Fork and Double Mountain formations do really overlie the Albany. The mistake in Dr. Cummins's stratigraphy lay in his extending the Clear Fork eastward into Baylor County.

The president then called for the paper by Dr. Dean.

The author showed a series of micro-photographs illustrating the remarkable preservation of the muscular tissue in the fossil sharks of the

Cleveland shale, and remarked upon its rarity and interest. The striation of the muscular fiber could be clearly observed. In one specimen the form and structure of the kidneys of both sides were shown.

The next paper was by Dr. Matthew, on a skull of *Apternodus* and skeleton of a new Artiodactyl from the lower Oligocene of Wyoming. The specimens in question were obtained for the University of Wyoming by Mr. W. H. Reed, to whose courtesy and to the good offices of Dr. Williston the author owed the privilege of description. The *Apternodus* is an Insectivore of the rare and primitive Zalambdodont division; it is the third and most complete fossil skull referable to this group. The structure is peculiar in several respects, but its nearest relationships appear to be with the Centetidæ of Madagascar. It affords some interesting data bearing upon the hypotheses regarding the origin of the tritubercular molar of mammalia. The second specimen represents a new stage of the Camel phylum, intermediate in most respects between *Protylopus* of the upper Eocene and *Paratylopus* and *Poebrotherium* of the middle Oligocene, but nearer to the former genus. The lateral digits of the fore feet are complete but slender; those of the hind feet are reduced to nodular rudiments. The proportions of the limbs, feet, skull and neck are as in *Protylopus*, lacking the elongate proportions of all the later camels; the tympanic bulla is of camelid type. The molar teeth are very short crowned and the upper molars peculiar in the development of a strong additional crest on the anterior wing of the posterior inner crescent. This crest is feebly developed in certain Giraffidæ, not known in other artiodactyla. Except in this peculiar feature the new genus represents very satisfactorily the lower Oligocene stage in the evolution of the Camelidæ.

The next paper was by Dr. Loomis upon the "Camels of the Lower Miocene." The author recognized two aberrant lines of camels, one represented by *Stenomylus*, the other by *Oxydactylus*, besides the more direct line of descent, imperfectly known at this stage of its evolution. A new species of *Stenomylus* was indicated by the series of complete skeletons found at the Amherst quarry, in which the premolars are further reduced than in the type of the genus. The author also showed drawings of a new species of peccary from this horizon.

The paper was discussed by Messrs. Cook, Matthew and Riggs.

Dr. E. S. Riggs then presented the results of his observations upon the Loup Fork beds of east-

ern Wyoming. The author had adopted in general the classification given by Mr. Hatcher. The Monroe Creek beds he had found hardly distinguishable from the Harrison and generally very barren. The Harrison beds are fossiliferous. The correlation between certain types of sediment and certain faunal groups of animals was noted. The strata were probably deposited by rivers in an open plains country. A list of the principal fossils was given, and the origin of the Dæmonelix beds was discussed at some length. The author had found remains of five different species of animals associated with the Dæmonelix spirals, viz., skulls and skeletons of *Steneofiber*, skeletons of two genera of carnivora, a jaw of *Merychys*, and parts of the skeleton of *Oxydactylus*. The last was partly without and partly within the spirals and the parts within had apparently been absorbed or eaten away. The other fossils lay completely within the spirals. Photographs of one of the carnivore skeletons were shown; the animal appeared to be coiled up in a natural position, as though resting upon a bed of sand within the cavity. It was concluded that at some stage of their formation these spirals had been open holes, but their mode of origin was still obscure. If they originated as burrows their formation must be ascribed to one only of the several animals found in them. In connection with a possible vegetable origin attention was drawn to the spirally coiled lianas common in tropical forests. These if buried in sand might decay and leave an open hole.

The paper was discussed by Messrs. Cook, Loomis and Matthew with regard to the correlation of the Harrison beds and the origin of Dæmonelix.

After which the meeting adjourned to 3:15 P.M.

The first paper of the afternoon session was by Dr. D. Matthew and Harold Cook, on a "Pliocene Fauna from Western Nebraska." The fossils described were from deposits lying just south of the divide between the Niobrara and North Platte Rivers in Sioux County, Nebraska, a new locality discovered by the authors last summer while prospecting in the interests of the American Museum of Natural History. The formation appeared to be a marginal phase of the Ogallala formation, and had been largely removed by æolian action, leaving in places only a residuum of gravels and coarser deposits of old channel beds, mantling the eroded surface of the Miocene beds. At other points the upper formation was more or less intact, and easily distinguished by the prevalence of true quartz sands and gravels of metamorphic and crystalline rocks. With the residual gravels of

the channel beds were great numbers of bones and teeth, mostly fragmentary and waterworn, but indicating a large and varied fauna. More than sixty species are represented by our collections, of which a considerable part are clearly new. Horses are the most abundant fossils, some hundreds of jaw-fragments and about ten thousand separate teeth being in the collection. All these belong to the Protohippine group, and are closely allied to those of the upper Miocene, but in some cases more specialized. *Equus* does not occur. A large variety of camels is present, some of gigantic size. The deer-antelope *Merycodus* is common, along with several kinds of true deer. The presence of true antelopes of the *Tragoceras* group is indicated by a horn, several upper jaws, teeth and skeleton bones. A single lower jaw is referable to the genus *Bison*, but its pertinence to this fauna is questioned. There are also several species of Oreodonts with a more advanced type of dentition than any described genera. Advanced species of the rhinoceros genera *Teleoceras* and *Aphelops* are present, and a Proboscidean of undetermined genus. The presence of Edentata is indicated by a single imperfect claw. Peccaries, several genera of rodents, and more than a dozen different Carnivora are represented. Most of them belong to known upper Miocene genera, but in several instances the species are more highly specialized. One lower jaw represents the modern genus *Bassariscus*, not heretofore known fossil. The age of the fauna is regarded as lower Pliocene, and the nearest comparisons are with the fauna of the Alachua clays of Florida and the Rattlesnake beds of Oregon.

In the underlying beds were found several skeletons of *Merychippus* and other genera, indicating that they are of middle Miocene age, equivalent to the Pawnee Creek beds of Colorado, and later than any of the Miocene beds in the Niobrara Valley to the north of them.

Discussion: Mr. Riggs observed that he had seen similar cases of residual deposits of bones in eastern Wyoming last summer.

Dr. Loomis remarked on the extraordinary abundance of animal remains gathered together within a small space at this locality.

Mr. Gidley observed upon the highly specialized character of the horses, which he thought compared most nearly with those of the Archer beds (Alachua clays).

Mr. Hussakof's paper then followed, "On a Method of Arranging Large Study Collections in Museums." The author described the methods of

arranging the fossil fish collections in the American Museum. They are placed in shallow trays in racks, an arrangement first introduced by Darwin. He advocated an arrangement primarily zoological, with a subordinate arrangement in alphabetic order. Special collections could be kept apart until studied and then merged in the general series. Space could be left for the addition of new material to the collections without disarranging the order. The paper was discussed by Mr. Gidley and Dr. Matthew.

The next paper was by E. B. Branson, "Notes on some Dinichthyids from northern Ohio." The author described a number of specimens of Dinichthyids recently collected for the museum of Oberlin College, including a fine skull of *D. intermedius* and a number of jaws and skull plates apparently of undescribed species. He also called attention to a specimen of Amphibian foot-prints from the Mauch Chunk shales of Pennsylvania.

Discussion: Dr. Hussakof inquired in regard to the occurrence of *D. intermedius* in the Delaware limestone as reported by Mr. Branson, and expressed some doubt as to the certainty of the horizon. He also noted the variable character of the mandible in the species of *Dinichthys*.

Mr. Branson, in reply, stated that there was no doubt as to the specimen in question being in place in the Delaware limestone.

The session was then adjourned.

On Wednesday, December 30, the society reconvened at 10 A.M. and proceeded with the program of papers.

Professor Osborn explained the plans of the International Committee on Geologic Correlation of the National Academy of Sciences. Professor Williston expressed his sense of the importance and desirability of the work as outlined. Dr. Loomis pointed out the need for field sections in the collecting of fossil vertebrates.

Professor Osborn then gave a preliminary report upon the skeleton of *Trachodon* discovered by Mr. Sternberg last summer. The specimen is articulated and complete except for the tail and hind feet. Careful preparation at the American Museum indicates that almost the whole integument is preserved, and the author described its character and pattern. The specimen was probably naturally mummified, and then buried by a mass of sand from a freshet. This skeleton, aside from its extraordinary interest in the preservation of the integument, will add considerably to our knowledge of the osteology of *Trachodon*, especially as regards the shoulder-girdle and its relations to the sternum and ribs. The paper was

illustrated by several slides, showing the locality and stages in the excavation of the specimen.

Professor Osborn then gave a brief description of the Cretaceous section in Montana in which the skeleton of *Tyrannosaurus* was found last summer, pointing out the sharp faunal distinction between the true Cretaceous and the Eocene part of the section.

Discussion: Professor Lull inquired whether this specimen throws any further light upon the supposed aquatic habits of *Trachodon*.

Professor Osborn replied that in general the view that these animals were waders rather than truly aquatic, appeared to be the most probable.

Dr. Williston inquired as to whether any carbon was preserved in the skin, as it is in so many instances in the Kansas chalk. He also recalled that in the excavation of the type specimen of *Morasaurus grandis* in 1878, considerable parts of the skin were found to be present in the form of a rather thick carbonaceous sheet. Owing to the unfavorable conditions, it was not then possible to preserve any part of the skin. He pointed out additional reasons against believing that the Dinosaurs were aquatic animals.

The problem of the habitat of the Sauropodous Dinosaurs was further discussed by Dr. Matthew, Dr. Williston, Mr. Riggs, Professor Lull and Mr. Gidley. Dr. Williston and Mr. Riggs advocated a terrestrial, Dr. Matthew and Mr. Gidley a wading, habit for this group.

In absence of Professor Osborn, Dr. Matthew then reported briefly upon the *Bison latifrons* skull recently acquired by the American Museum. This is believed to be the finest fossil bison skull on record. It measures nearly six feet from tip to tip of the horn-caves; the skull is but slightly larger than that of *B. americanus*, but shows several differences in form. It was discovered some years ago near Hoxie, in northwestern Kansas.

Discussion: Dr. Case mentioned a fine fossil bison skull in the collection of Iowa University. Dr. Williston observed that there was a very fine skull in the Leland Stanford University collections. It had not, he believed, been mentioned in print. He further discussed the characters of the different species of *Bison* and the geological horizon of *B. alleni*, reported by Marsh as Pliocene but probably Pleistocene. The living species *B. americanus* is also found in the late Pleistocene.

The program of papers being completed, the business meeting of the society followed.

The nominating committee reported that they

had agreed upon the names of Dr. J. C. Merriam for president and Mr. E. S. Riggs for secretary and treasurer. These nominations were accepted by the society and Messrs. J. W. Gidley, Barnum Brown and F. B. Loomis were then nominated as executive committee, and there being no further nominations, the secretary was instructed to cast a ballot for the nominees, and they were duly elected.

It was further resolved that the secretary with an assistant from the executive committee should have charge of the arrangement of program for the ensuing meetings, to avoid conflict with the programs of related societies whose meetings the members might wish to attend.

The following gentlemen were then proposed for membership: Professor E. R. Branson, Oberlin College, Ohio; Dr. Roy L. Moodie, Kansas University; Mr. W. H. Reed, University of Wyoming; Mr. C. H. Sternberg, Lawrence, Kansas; Professor C. E. McClung, Kansas University. After each name had been individually balloted upon, the president declared the unanimous election of all to membership in the society.

On motion of Dr. Loomis the following resolution was passed:

Resolved, That the American Society of Vertebrate Paleontologists, having found the "Bibliography and Catalogue of Fossil Vertebrates of North America," issued as a bulletin of the U. S. Geological Survey, of the greatest service in expediting research, do hereby request the director of the survey to prepare and publish a supplement to the same, to include the bibliography from 1900 to 1910, and do respectfully tender all assistance possible.

It was then resolved that the society express its appreciation and thanks to Professor Clarke and the Johns Hopkins University for their courtesies and efforts which had done so much to promote the success of the Baltimore meeting.

After which the society adjourned.

W. D. MATTHEW,
Secretary

SOCIETIES AND ACADEMIES

THE GEOLOGICAL SOCIETY OF WASHINGTON

At the 209th meeting of the society, held at the Cosmos Club, on Wednesday evening, November 11, 1908, Mr. Willis T. Lee spoke informally on an occurrence of coal changed to coke and graphite in the Raton, New Mexico, coal field.

During some period of volcanic activity after the coal beds had been formed igneous rock was